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The evaluation of asthma by gender and age groups in Turkey, in 1990-2019: incidence, prevalence, mortality, and disability-adjusted life years

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ABSTRACT

Aims: The aim of this study was to evaluate the incidence and prevalence of asthma, asthma-related DALYs and deaths, and risk factors for asthma by genders and age groups during the study years in Turkey.

Methods: The data used in the study were obtained from the estimation data prepared by the Institute for Health Metrics and Evaluation on asthma for Turkey by the global burden of disease study covering the years 1990-2019. During the study years period, death from asthma and Disability-Adjusted Life Years (DALYs) were used as dependent variables. In addition, the effects of Occupational Asthmagens (OA), Smoking (SM), and High Body Mass Index (HBMI), which are known as risk factors for asthma-related deaths and DALYs, were investigated. Comparisons of the variables according to gender and age groups were made with the Mann-Whitney test. The relationships between the variables were examined with the Spearman rank correlation coefficient (Rho).

Results: A statistically significant difference was found between the mean rank of total prevalence number, total incidence number, total number of deaths and DALYs scores by gender. Asthma-related deaths due to risk factors (OA, HBMI, SM) were found to be correlated with DALYs and the total number of asthma deaths. Total asthma deaths, and asthma-related deaths because of HBMI and DALYs because of HBMI-induced asthma in women; deaths from asthma because of OA, SM, and DALYs from asthma because of OA and SM were found to be higher in males.

Conclusion: HBMI in women and SM and OA in men stand out as risk factors. Therefore, as a result of a detailed investigation of the risk factors leading to the development of asthma, policies should be developed for gender and age groups, and necessary precautions should be taken.

Keywords: Asthma deaths, DALY, prevalence, incidence, risk factors

INTRODUCTION

Asthma; is a chronic lung disease that can cause structural and functional changes, causing symptoms such as recurrent wheezing, coughing, shortness of breath, and chest tightness.[1] Asthma is an important non-communicable disease affecting both children and adults.[2] Asthma is estimated to affect 262 million people worldwide[3] and cause 455 thousand deaths in 2019.[2]

Factors such as allergens (dust, mold, pet hair, etc.), environmental factors (air pollution, chemicals, etc.), genetic and behavioral factors (smoking, high body mass index -obesity- etc.) cause asthma and the disease for those with existing disease. increases the severity.[4-8] Smoking causes disease through both direct use and exposure to smoke.[8] Occupational asthma occurs when the person is exposed to the factors that cause the disease in the working environment.[4]

One Disability-Adjusted Life Year (DALY) represents a loss equivalent to one year of complete health loss.[9] It is also equal to the sum of the number of healthy years lost because of mortality and morbidity.[10] DALYs are included in the study because they include years of healthy life lost not only because of death but also because of disease. In this study, asthma incidence, prevalence, asthma-related DALYs and deaths, and risk factors causing asthma in Turkey will be evaluated according to gender and age groups during the study years.

METHODS

Since public data was used in this study, there is no need for an ethics committee decision. All transactions were carried out in accordance with ethical rules and principles. In the study, it was obtained from the estimation data prepared

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by the Institute for Health Metrics and Evaluation (IHME-healthdata.org) on asthma disease for Turkey in the global disease burden study covering the years 1990-2019.[11] The variables investigated in the study include asthma-related deaths, asthma-induced DALYs, asthma incidence, and asthma prevalence. Asthma-related deaths and DALYs have been associated with three different risk factors; Occupational asthmagens (OA), Smoking (SM), and High Body Mass Index (HBMI). A risk factor is a condition that causes disease in people who carry it, resulting in death or disability.[12] The death and DALY variables used in the study and caused by risk Factors are as follows: (1) OA-induced asthma-related deaths (OAD), (2) SM-induced asthma-related deaths (SMD), (3) HBMI-induced asthma-related deaths (HBMID). (4) OA-induced asthma-induced DALYs (OADALYs), (5) SM-induced asthma-induced DALYs (SMDALYs), and (6) HBMI-induced asthma-induced DALYs (HBMIDALYs). The selection of risk factors could be made according to the availability of data in IHME.

For each of the variables described above, the number (number of deaths in the population), percent (proportion of deaths from a specific cause compared to deaths from all causes), and rate (deaths per 100,000 population) values were obtained. Each of the variables used in the study was evaluated according to gender (female, male, and all genders together) and age groups. Since data can be obtained in the range of 1-95+ years for HBMI, 30-95+ years for SM and 15-84 years for OA, age groups are arranged accordingly and evaluated as 5-year age groups at the specified intervals.

Within the scope of the research, the conformity of the number, percent, and rate values collected for death and DALYs to the normal distribution was examined graphically and using the Shapiro-Wilk test. It was determined that the values of all the variables examined were skewed and did not comply with the normal distribution. All descriptive statistics are given as median (IQR: Inter Quartile Range). Comparisons by gender were made using the Mann-Whitney test. The relationships between the variables used in the study were examined with the Spearman rank correlation coefficient (Rho).

Ms-Excel 2016 and IBM SPSS Statistics 22.0 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY, IBM Corp.) programs were used for statistical analysis, calculations, and graphic drawing. In statistical decisions, $p<0.05$ was accepted as an indicator of a significant difference.

RESULTS

Total asthma-related deaths (**Figure 1-a**), deaths due to risk factors causing asthma (**Figure 1-b, c, d**), and DALYs caused by risk factors (**Figure 1-f, g, e**) are presented graphically.

It is shown that the total number of asthma deaths, HBMID and HBMIDALYs were higher in women; OAD, SMD, OADALYs, and SMDALYs were higher in men. When evaluated by years, there was an increase in HBMID and HBMIDALYs, while death because of other factors and a decrease in DALYs (only DALYs because of smoking increased slightly in women).

A statistically significant relationship ($p<0.001$) was found between the total number of asthma-related deaths and three asthma risk factors for all age groups. While a very strong relationship was found between the total number of deaths from asthma and HBMI in all age groups, a strong relationship was also found between OAD and SMD. The relationship between the total number of deaths from asthma, OAD, and SMD decreases with increasing age (**Table 1**).

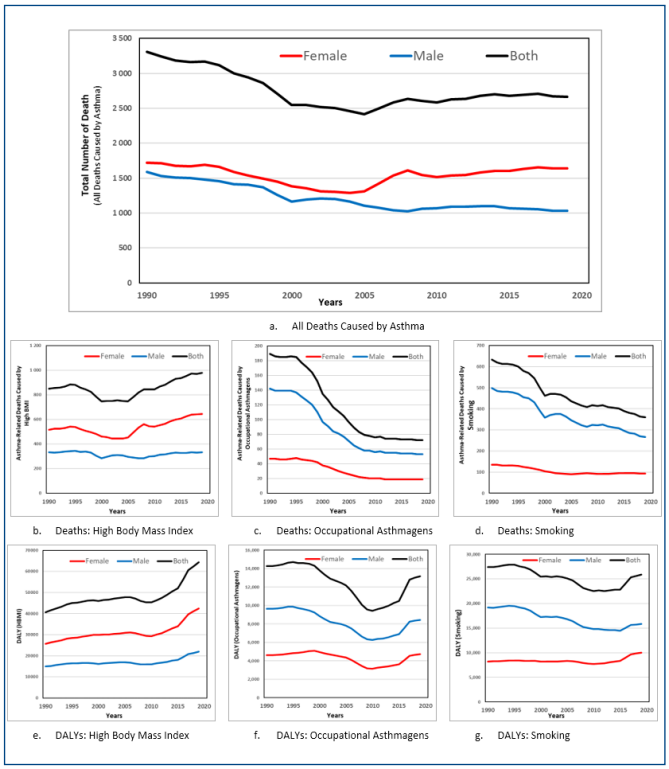

Figure 1. Number of Asthma-related deaths and DALY's by gender and year

Table 1. Relationships between total number of deaths and risk factors for all age groups (years)

Age_Grup (Years-Deaths*)	HBMID**		OAD***		SMD****	
	Rho	p	Rho	p	Rho	
1-4	0.991	<0.001	–	–	–	–
5-9	0.995	<0.001	–	–	–	–
10-14	0.977	<0.001	–	–	–	–
15-19	0.976	<0.001	0.971	<0.001	–	–
20-24	0.981	<0.001	0.937	<0.001	–	–
25-29	0.979	<0.001	0.823	<0.001	–	–
30-34	0.973	<0.001	0.780	<0.001	0.813	<0.001
35-39	0.975	<0.001	0.761	<0.001	0.844	<0.001
40-44	0.967	<0.001	0.663	<0.001	0.702	<0.001
45-49	0.945	<0.001	0.750	<0.001	0.813	<0.001
50-54	0.943	<0.001	0.810	<0.001	0.804	<0.001
55-59	0.910	<0.001	0.868	<0.001	0.836	<0.001
60-64	0.893	<0.001	0.827	<0.001	0.832	<0.001
65-69	0.948	<0.001	0.668	<0.001	0.655	<0.001
70-74	0.875	<0.001	0.598	<0.001	0.629	<0.001
75-79	0.965	<0.001	0.350	0.001	0.519	<0.001
80-84	0.982	<0.001	0.402	<0.001	0.451	<0.001
85-89	0.983	<0.001	–	–	0.402	<0.001
90-94	0.961	<0.001	–	–	0.435	<0.001
95+	0.982	<0.001	–	–	0.269	0.010

*Number: Number of deaths in the population.
**OAD: Number of asthma-related deaths caused by Occupational Asthmagens
***SMD: Number of asthma-related deaths caused by Smoking
****HBMID: Number of deaths from asthma caused by High Body Mass Index

When the relationships between the number of asthma deaths due to risk factors were analyzed according to age groups, a significant relationship was found between HBMID and OAD for all age groups, except for the 75 and over age group ($p<0.05$). On the other hand, there was a significant relationship between

HBMID and SMD in all age groups (p<0.05), except for the 95-year-old and older group, but the strength of the relationship decreased as age increased. A very strong correlation was found between OAD and SMD in the same direction for each group between the ages of 30-84 (p<0.001) (**Table 2**).

Table 2. Relationships between risk factors for all age groups (years)

Age_Grup (years-number*)	HBMID**-OAD***		HBMID-SMD****		SMD-OAD	
	Rho	p	Rho	p	Rho	p
15-19 years	0.969	<0.001	–	–	–	–
20-24 years	0.943	<0.001	–	–	–	–
25-29 years	0.770	<0.001	–	–	–	–
30-34 years	0.672	<0.001	0.709	<0.001	0.996	<0.001
35-39 years	0.668	<0.001	0.755	<0.001	0.981	<0.001
40-44 years	0.509	<0.001	0.543	<0.001	0.990	<0.001
45-49 years	0.585	<0.001	0.656	<0.001	0.989	<0.001
50-54 years	0.639	<0.001	0.635	<0.001	0.990	<0.001
55-59 years	0.666	<0.001	0.611	<0.001	0.991	<0.001
60-64 years	0.579	<0.001	0.567	<0.001	0.986	<0.001
65-69 years	0.454	<0.001	0.443	<0.001	0.985	<0.001
70-74 years	0.261	0.013	0.294	0.005	0.990	<0.001
75-79 years	0.193	0.069	0.343	0.001	0.841	<0.001
80-84 years	0.273	0.009	0.332	0.001	0.834	<0.001
85-89 years	–	–	0.301	0.004	–	–
90-94 years	–	–	0.276	0.009	–	–
95+ years	–	–	0.176	0.097	–	–

*Number: Number of deaths in the population.
**HBMID: Number of deaths from asthma caused by High Body Mass Index
***OAD: Number of asthma-related deaths caused by Occupational Asthmagens
****SMD: Number of asthma-related deaths caused by smoking

Total number of deaths because of asthma (Z=5.515; p<0.001), total percent of death (Z=6.653; p<0.001) and total rate of death variables (total rate of death) by gender. The difference between mean rank (Z=3.977; p<0.001) was statistically significant. It was determined that the number of women who died because of asthma was higher than that of men. The difference between the mean rank of incidence (Z=5.248; p<0.001) and prevalence (Z=6.653; p<0.001) according to gender was also statistically significant (**Table 3**).

Table 3. Death, Incidence, Prevalence: By Gender (years, all ages)

	Both	Female	Male	Female vs Male
Death Number**	82649	46194	36455	Z=5.515; p<0.001
Death Percent***	0.0072	0.0092	0.0057	Z=6.653; p<0.001
Death Rate****	3.90	4.39	3.43	Z=3.977; p<0.001
Incidence*	0.115	0.127	0.102	Z=5.248; p<0.001
Prevelance*	4.981	5.909	4.041	Z=6.653; p<0.001

* Incidence and prevalence; for all age groups, the 30-year percent average is *100.
**Number: Number of deaths in the population
***Percent: Proportion of deaths from a specific cause compared to deaths from all causes
****Rate: Deaths per 100,000 population

Relationships between risk factors that cause asthma-related deaths were examined, and the results are given in Table 4. In all genders (both), HBMID was found to have an inverse, moderately strong correlation with both OAD (Rho=-0.426; p=0.019) and SMD (Rho=-0.417; p=0.022). In women, an inverse and strong correlation was found between HBMID and OAD (Rho=-0.610; p<0.001). No significant relationship was found between HBMID and SMD when both men and women were evaluated separately. Between OAD and SMD, a strong correlation was found in the same direction as women (Rho=0.759; p<0.001); A very strong correlation was found in the same direction in men (Rho=0.985; p<0.001) and all genders (Rho=0.988; p<0.001) (**Table 4**).

Table 4. Relationships between the number of deaths caused by risk factors by gender (years, all ages)

Gender	HBMID** - OAD*		OAD-SMD***		HBMID-SMD	
	Rho	p	Rho	p	Rho	p
Both	-0.426	0.019	0.988	<0.001	-0.417	0.022
Female	-0.610	<0.001	0.759	<0.001	-0.125	0.510
Male	0.299	0.108	0.985	<0.001	0.337	0.069

*OAD: Number of deaths from asthma caused by Occupational Asthmagens
**HBMID: Number of deaths from asthma caused by High Body Mass Index ***SMD: Number of asthma-related deaths caused by smoking

DALYs were compared by gender and are presented in Table 5. It was found that HBMIDALYs for women were almost twice as high as for men (Z=6.653; p<0.001). However, it was determined that OADALYs and SMDALYs for men, on the contrary, were at a level of twice that of women. The DALYs resulting from the three risk factors examined by gender differ (p<0.001) (**Table 5**).

Table 5. Median DALYs score by gender (years, all ages)

DALYs	Both	Female	Male	Female vs Male
HBMIDALYs*	46390.19 (2835.90)	30036.47 (2297.25)	16532.15 (854.02)	Z=6.653; p<0.001
OADALYs**	12873.74 (3879.23)	4603.58 (1179.05)	8251.33 (2785.65)	Z=6.653; p<0.001
SMDALYs***	25429.25 (4289.64)	8277.58 (197.31)	16968.56 (3982.04)	Z=6.653; p<0.001

*HBMIDALYs: DALYs from asthma caused by High Body Mass Index
**OADALYs: Asthma-induced DALYs caused by Occupational Asthmagens
***SMDALYs: DALYs from asthma caused by Smoking

DISCUSSION

Although the incidence, prevalence, and severity of asthma increase with adolescence, they are higher in women.[13] It is estimated that women-specific conditions such as early puberty, pregnancy, and menopause affect asthma.[14] In this study, consistent with the literature, it was found that the number of asthma-related deaths and the incidence and prevalence of asthma were higher in women. It seems that asthma and obesity tend to increase in parallel, and there may be a potential link between these two conditions.[7] As a result of the research, it was determined that HBMID and HBMIDALYs were higher.

In a study, it was determined that 60% of 8239 work-related asthma cases developed by workers in various business lines were women.[15] Exposure of women to various chemicals, especially in jobs such as food, textiles, and cleaning, is associated with higher asthma.[15,16] However, occupational asthma is also said to be unrelated to gender.[17] Men are more likely to be exposed to pyrolysis products, plant-based materials, isocyanates, metals, and metalloids.[18] It is thought that the stimuli causing occupational asthma are also different due to the fact that men and women work in different work environments. In this study, unlike the literature, occupational asthma was found to lead to higher mortality and DALYs in men. This can be explained by the fact that men are exposed to more work-related stimuli, as the labor force participation rate for men aged 15 and over is 70.3% in Turkey.[19] The fact that smoking rates are higher in men indicates it may be a more effective risk factor than women.[20] In this study, causes of death because of asthma caused by smoking and the DALYs score were found to be higher in males.

CONCLUSION

Asthma is a disease that affects both children and adults and has high DALYs because of the disability it causes. Although the risk factors that cause asthma cannot be completely eliminated, policies aimed at least reducing them will prevent people from falling behind in social and work life, as well as improving their health status. The incidence, prevalence, and deaths of the disease are higher in women. However, when evaluated according to risk factors, smoking, which is one of the occupational and behavioral factors in men HBMI, which is one of the metabolic factors, are seen to cause higher deaths and DALYs in women. For this reason, it is thought that following different policies according to gender will be effective in preventing the disease and reducing the damage caused by the disease. According to the study findings, for men, reducing exposure to factors that cause asthma risk in the work environment and promoting smoking cessation; For women, it can be said that the prevention of obesity will be beneficial.

ETHICAL DECLARATIONS

Ethics Committee Approval: Since public data was used in this study, there is no need for an ethics committee decision.

Informed Consent: Since public data was used in this study, there is no need for an informed consent.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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